An Introductory Radio Astronomy Text for High School Students, Teachers, and Community Volunteers

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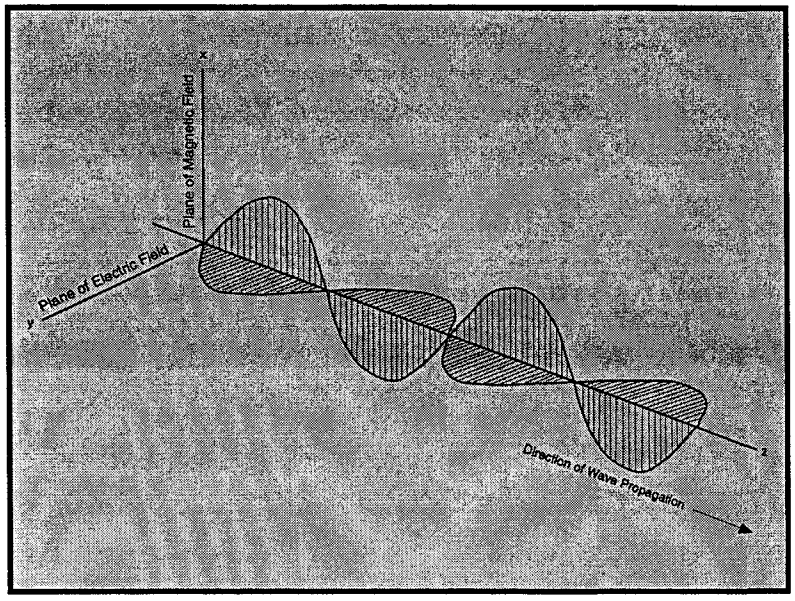
The Lewis Educational Research Center in Apple Valley, California, is a community resource built and operated by donations from local businesses and private citizens, as well as grants from such agencies as the National Science Foundation. Its primary purpose is to serve the Apple Valley Unified School District and its community by providing curriculum enrichment in areas of science and technology.

In 1997, the National Aeronautics and Space Administration (NASA) donated to the Lewis Center the use of NASA's decommissioned 34-meter antenna at the Goldstone, California, complex. The antenna had been part of the Deep Space Network, which supports NASA's (and others') robotic space missions. The Jet Propulsion Laboratory (JPL), which operates the network for NASA, made relatively minor modifications to the antenna so that it could be used as a radio telescope and operated remotely by students and teachers at the Lewis Center. The antenna is now known as the Goldstone-Apple Valley Radio Telescope.

JPL also worked with the Lewis Center to establish protocols and procedures, set up meaningful research projects, and train its community volunteers, teachers, and, ultimately, students to operate the telescope and interpret its data. The first item on the radio telescope training agenda was to introduce the whole idea of radio astronomy. We assumed that most of our intended trainees barely understood what part of the electromagnetic spectrum radio astronomy dealt with, much less where this energy came from and what it could tell us. So we set out to develop a brief, self-administered workbook that would introduce the basic concepts at a level appropriate to our audience. From there, trainees would be in a better position to learn about the telescope itself, how to operate it, and what the data meant.

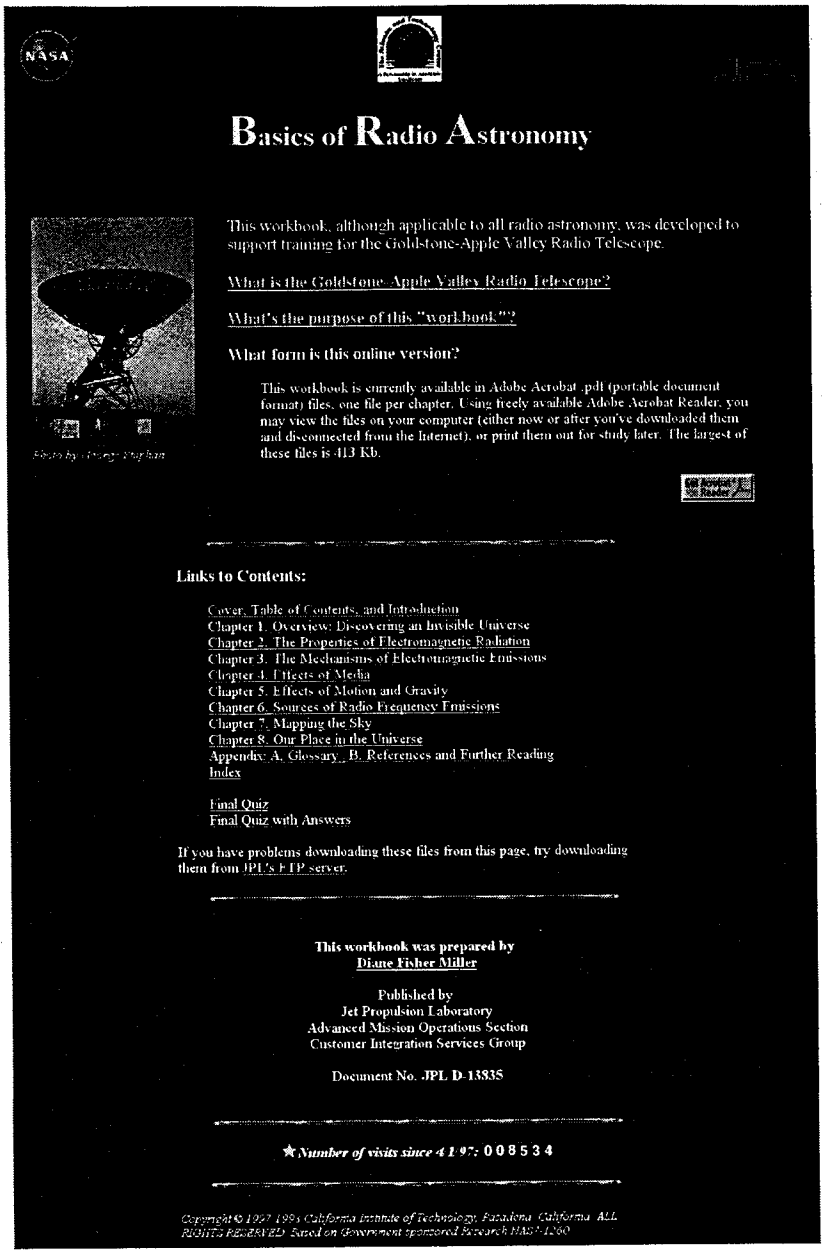


Example of a conceptual drawing from radio astronomy workbook, this one illustrating electric and magnetic fields at right angles.

We had to assume a few things about the background of our audience. We geared our material to high school graduates who had taken chemistry, physics, and basic algebra. We avoided math almost entirely, instead seeking to impart a basic grasp of broad concepts, as well as to generate some enthusiasm for the subject.

Next we had to choose our topics. Most of the materials we found that dealt specifically with radio astronomy were aimed at graduate or post-graduate astronomers, with most pages containing more equations than words! We used these materials to glean our choice of broad topics, but then sought simpler, more concept-oriented explanations of topics in general astronomy and physics texts.

We ended up with a workbook of less than 100 pages, liberally illustrated, with self-test quizzes throughout and lots of references for further investigation of specific topics of interest. At the back of each copy of the workbook is a "final quiz" on the entire book. The workbook was reviewed and approved by several radio astronomers at JPL, as well as engineers and scientists of other disciplines, and "lay persons."



Basics of Radio Astronomy home page, with links to .pdf files.

In addition to distributing hard copies for use at the Lewis Center, we made the workbook available on the world wide web in .pdf (Adobe Acrobat Reader) format. (Our audience seemed to prefer to print the entire workbook themselves and take it away to study, rather than reading it online.) The workbook was linked from JPL's oft-visited home page. It is in the public domain, available for unlimited reproduction for educational use. (If excepts are taken, proper credit to NASA, JPL, and the author must be given.)

Within a few weeks of its availability online, the National Radio Astronomy Observatory had adopted the workbook as part of its telescope operator training. The workbook has been a very successful part of the training on the Goldstone-Apple Valley Radio Telescope. In addition to its originally intended audience of teachers and Lewis Center volunteers from the community, it has been given directly to the students (high school level). The Lewis Center, with assistance from JPL astronomers and engineers, now presents a six-day training course at the Lewis Center to prepare not only local teachers and volunteers to operate the telescope, but also teachers from across the U.S. who wish to conduct their own classroom research projects using the telescope remotely via the internet. In order to begin this course, participants must have already read the workbook and submitted the completed final quiz.

If our research is valid evidence, our workbook seems to fill a real gap in radio astronomy learning materials. After spending some time with the workbook, non-science majors and other "ordinary folks" can have a considerable awareness of the subject of radio astronomy, with a foundation of understanding and, perhaps more important, interest upon which to build further inquiry. After studying our book, it is reasonable to say that one could even understand almost everything said in the movie "Contact"!

The Basics of Radio Astronomy workbook can be found at

http://www.jpl.nasa.gov/radioastronomy.

The web site for the Lewis Center for Educational Research is at

http://www.avstc.org.

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Diane Fisher Miller is a science and technology writer and web site developer at the Jet Propulsion Laboratory. She holds a bachelor's degree in English and has been at JPL 15 years.